Employers' recruitment behaviour and vacancy duration; An empirical analysis for the Dutch labour market

Gorter, C.; Nijkamp, P.; Rietveld, P.

published in
Applied Economics
1996

DOI (link to publisher)
10.1080/000368496327723

document version
Publisher's PDF, also known as Version of record

citation for published version (APA)
Gorter, C., Nijkamp, P., & Rietveld, P. (1996). Employers' recruitment behaviour and vacancy duration; An empirical analysis for the Dutch labour market. *Applied Economics*, *28*(11), 1463-1474. https://doi.org/10.1080/000368496327723

Applied Economics, 1996, **28**, 1463–1474

Employers' recruitment behaviour and vacancy duration: an empirical analysis for the Dutch labour market

CEES GORTER, PETER NIJKAMP and PIET RIETVELD

Department of Economics, Free University Amsterdam, Boelelaan 1105, 1081 HV Amsterdam, The Netherlands

The functioning of labour markets from a demand-side perspective is examined. In particular, the determinants of vacancy duration are studied in the context of a model of employers' search behaviour. A model for the choice of the recruitment strategy at the start of the search process and the corresponding recruitment duration is developed in which allowance is made for different patterns of duration dependence for each recruitment strategy. This model is applied to data on employers' search behaviour in the Dutch labour market. It is found that employers prefer advertisements as the first recruitment channel when applicants are required to have work experience. Moreover, employers prefer to start searching via the labour exchange office when jobs in the secondary segment of the labour market have to be filled. It is also found that – when advertisements are used as the first recruitment strategy – employers need some time to acquire a pool of applicants and to select candidates from this pool. It is interesting as a contrast that applicants seem to be evaluated rather quickly if employers start searching via informal contacts.

I. INTRODUCTION

Since the beginning of the 1980s unemployment has shown dramatic growth in the Netherlands. Even though there has been a remarkable rise in the number of jobs (starting in the mid-1980s), the reduction of unemployment is still modest. Paradoxically, employers' associations complain about vacancies that are hard to fill. Apparently, there is an increasing mismatch of demand and supply in the Dutch labour market.

At the micro level, imbalances in the labour market have, in a large number of studies, often been analysed on the basis of supply side indicators, such as the duration of unemployment (see, e.g. the pioneering studies of Lancaster, 1979; Nickell, 1979). These studies are usually based on the theory of job search (for an overview see Mortensen, 1986). Much less attention has been paid to demand side indicators of the functioning of the labour market, such as vacancy duration (see for example, Beaumont, 1978; Roper, 1988; Renes, 1989; van Ours, 1989 and 1990; and Gorter, 1991). This is not surprising since data on vacancies in most countries are rather poor or absent.

The aim is to study employers' recruitment behaviour and vacancy duration by using micro data on filled vacancies in the Dutch labour market. A careful identification of the determinants of the duration of a vacancy may provide a better insight into the potential of employers in the labour market to fill different kinds of jobs. Jobs with a short duration of vacancy tend to occur when there is a surplus of workers suitable to fill these jobs, while vacancies which are hard to fill suggest that there is a shortage of workers for them. One should realize, however, that differences in vacancy duration may also reflect differences in the duration of recruitment procedures for different jobs. It has been argued by van Ours and Ridder (1992) that 'vacancy durations in the Dutch labour market are mainly selection periods and not search periods for applicants', because they found that 'almost all applicants arrive shortly after the vacancy has been announced'. Hence, they concluded that 'employer search is mostly non-sequential', which means that 'employers advertise a vacancy and thereby

0003–6846

form a pool of applicants'. This conclusion is confirmed by the follow-up study of van Ours and Ridder (1993) in which they explicitly distinguish between the application and the selection period. However, when van Ours and Ridder (1993) disaggregate by education they find evidence that low skilled jobs are filled sequentially.

In this paper, we shall examine how vacancies are filled when employers use different recruitment strategies. For example, employers may decide to use informal contacts inside or outside the firm before placing an advertisement. This search strategy might lead to a short duration period for some vacancies.[1] An attempt will be made to shed light on this issue by studying the determinants of vacancy duration for each recruitment strategy separately. Moreover, we shall investigate which factors determine the decision to activate a recruitment channel.

The paper is organized as follows. In Section II, we present some information on the Dutch labour market and a brief overview of recruitment practices in the Netherlands. Then, in Section III, we shall present the model of employers' search which will be used to analyse our duration data for the Netherlands. After having discussed the explanatory variables of the model in Section IV, we shall present the estimation results in Section V. Finally, Section VI contains some concluding remarks.

II. UNEMPLOYMENT, VACANCIES AND RECRUITMENT IN THE DUTCH LABOUR MARKET

The Dutch labour market has been characterized by substantial quantitative and qualitative discrepancies during the 1980s. First of all, unemployment has shown a dramatic growth at the beginning of this period (in absolute numbers, from 325 000 in 1980 to 820 000 in 1984). Since the mid 1980s, the situation, reflected by a growth of employment from − 2% in 1982/83 to 4% in 1985/86 has remarkably improved. In contrast to this upswing in labour demand, the reduction of unemployment has been modest in the second part of this decade. This is – among other reasons – due to the rise in labour force participation (the participation rate of women, in particular, increased significantly: from 35% in 1980 to 45% in 1990). Also, there appeared to be a significant lack of specific job opportunities for certain socioeconomic groups in the Dutch labour market.

Another indication of the increase in labour demand is the growth of job vacancies. Aggregate data on vacancies can be obtained from the vacancy surveys of the Central Bureau of Statistics (CBS). In these vacancy surveys some 20 000 firms were asked whether they had vacancies at the date of the survey. The CBS vacancy surveys are conducted on an annual basis.

Fig. 1. *Unemployment and vacancy rates in the Netherlands, 1980–88*

Unemployed workers in the Netherlands have to register at the public employment office to be entitled to unemployment benefits. Aggregate data on unemployment are available (monthly) from this registration. When we combine the macrodata on unemployment and vacancy data (see Fig. 1), we observe the development of the unemployment and vacancy rates over time. As mentioned before, the unemployment rate in the Netherlands has risen substantially during the 1980s. In 1980 it was about 7%, in 1984 it was about 18%. Since 1984 unemployment decreased somewhat. The vacancy rate decreased from 1.2% in 1980 to 0.5% in 1983, but increased again in later years.

An important institutional feature of the functioning of the Dutch labour market is (as in many Western European countries) that layoff costs are very high due to stringent regulations that protect workers against 'unreasonable layoffs'. In the Netherlands, the law demands that an employer must have acceptable reasons to lay off workers (for more details see Hassink, 1996). It is well-known that high layoff costs lead to a slow downward adjustment of employment (see, for example, Hamermesh, 1993). Recently, empirical evidence has been found for the Netherlands that layoff costs are substantially higher than hiring costs (see Hassink, 1996). Hassink also argues, however, that downward adjustment of employment at the firm's level may be faster than upward adjustment when the firm encounters a sufficient number of voluntary quits (these are assumed to be costless for the firm in his analysis). This implies that voluntary quits may be an important instrument for firms that wish to

[1] The literature focusing on the supply-side of the labour market (see for example, Osberg, 1993 for Canada), which emphasizes the large number of jobs obtained by personal contacts and direct approaches to the firm, suggests that some jobs are filled sequentially.

Table 1. *Recruitment methods in the Netherlands, 1986*

Search channel opened first	Relative use (%)	First = hiring (%)	More than one channel used (%)	Vacancy duration (in weeks)
Advertisements	33	92	28	5.7
Informal contacts	33	56	59	4.1
Labour exchange office	13	63	61	4.3
Others	21	71	44	4.2

Source: 'How do Firms Recruit?' (1986), ILBO.

reduce their work force. In addition, Dutch employers have – to a large extent – also resorted to encouraging workers to enter the state of disability and receive high benefits (even when they were not disabled in a strict sense), as an alternative to laying off workers (as can be seen from the substantially higher proportion of disabled persons in the Netherlands in comparison with other European countries; see, e.g. Aarts *et al.*, 1993).[2]

Microdata on job vacancies in the Netherlands are available in the Dutch CBS survey, since here some questions are asked about the characteristics of the vacancies when firms report them. However, this information is limited in nature (see, for example, van Ours and Ridder, 1991). Nevertheless, the CBS survey provides interesting data on the use of the labour exchange office, showing that its use has substantially declined over time (see also van Ours, 1994). The share of vacancies notified at the labour exchange office decreased from 63% in 1980 to 43% in 1986 (and even 33% in 1987). Apparently, the recovery of the Dutch economy in the second part of the 1980s did not coincide with a greater use of the labour exchange office. In this respect, it should be emphasized that – as in many other countries – employers are not obliged to register their vacancies at the Dutch labour exchange office. It is also noteworthy that the Dutch labour exchange office will send applicants to the employer (when requested) without charge. Nevertheless, we observe – as mentioned above – a considerable decline in the (relative) use of the labour exchange office. The main reasons for the reluctance of employers to make use of the services of the Dutch labour exchange office are twofold, according to van Ours (1994): 'employers complain because applicants are sent too slow and do not fit the requirements of the employer in either ability or motivation'. Interestingly, van Ours (1994) shows – by means of matching analysis – that the labour exchange office 'can improve the matching of unemployed and vacancies by applying intensive mediation methods'. An additional reason for the low market share of the labour exchange office is the existence of a negative stigma attached to applicants originating from a labour exchange office (note that this is also observed in other countries, see, e.g. for the UK labour market, Adnett, 1987). Barron and Mellow (1982) have explained this stigma effect by the fact that the labour exchange office will send applicants who are less likely to accept a job offer. As a result, firms are confronted with higher screening cost per vacancy when using the labour exchange office. Nonetheless, when it is used the labour exchange office appears to be quite effective in matching unemployed workers and vacancies in the Netherlands (see Lindeboom *et al.*, 1993; Gorter *et al.*, 1993).

A different, very rich, data source on vacancies and recruitment practices in the Netherlands stems from a survey by the ILBO Institute carried out on request of the Dutch Ministry of Social Affairs and Employment (the survey was called 'How do Firms Recruit?'). This survey provides useful information on the (sequential) activation of various recruitment methods, the length of recruitment duration and also on the success of different recruitment channels (see also Section IV when we describe this dataset in full detail). Table 1 summarizes the main features of the recruitment practices of Dutch firms in 1986.

It can be observed that employers usually start searching for applicants via advertisements (as can be seen from the 'market' share of 33%) or by using informal contacts (33%). The labour exchange office is much less often activated as a first channel (13%). Advertisements appear to be extremely effective since in almost all cases (92%) the opening of this channel first leads to the hiring of an applicant via this channel (i.e., it becomes the hiring channel). When an employer uses informal contacts first, it turns out to be the hiring channel in about half of all cases (56%), whereas the labour exchange office has a success rate of 63% (when opened as a first channel). It is also striking to observe the differences across channels regarding the proportion using more than one channel in the entire recruitment procedure. In the case of advertisements this figure is 28%, whereas it is 59% when informal contacts are first activated. Finally, we notice that the mean vacancy duration is – on average – higher for advertisements (about six weeks) and lower when informal contacts are first used (approximately four weeks). The latter observation supports the findings of Roper (1988)

[2] Note also that many firms in the Netherlands went bankrupt at the beginning of the 1980s, which led to an enormous rise in unemployment and decrease in employment (as discussed above).

for the UK, which show also that the informal method is the fastest in vacancy filling and newspaper advertisements the slowest recruitment strategy.

Finally, it should be re-emphasized (see also Section I) that previous empirical research on employers' search strategies in the Netherlands has shown evidence that almost all applicants arrive during the first two weeks after the announcement of the vacancy (see van Ours and Ridder, 1992). Apparently, it is beneficial for the employer first to form a pool (mainly as a result of placing an advertisement or notifying the labour exchange office) and to select the best candidate from this pool in the second stage of the recruitment process.[3]

III. A MODEL OF EMPLOYERS' SEARCH

In this section, we shall develop an operational model of employers' search behaviour which allows for sequential use of recruitment channels, since our data reveal that recruitment channels are not opened simultaneously (see Section IV). Consequently, employers are assumed to start searching for applicants by activating a recruitment channel (for example, placing an advertisement). We assume that the employer will choose the channel with the highest difference between expected benefits and costs of using that channel. In the following phase of the recruitment process, employers delay the screening process and selection procedures until a pool of applicants is acquired via that channel. Next, the 'best' applicant in the pool is selected on the basis of a set of suitable qualifications.[4] Finally, the employer decides whether the selected applicant (from the pool) is acceptable by comparing the expected productivity of the applicant with the minimum required productivity level (i.e., the reservation productivity). If this selected applicant is not acceptable, the employer continues his recruitment by (i) activating an additional recruitment channel, (ii) re-activating the 'old' channel (for example, placing a second advertisement), and/or (iii) waiting for the arrival of new applicants via the 'old' channel.[5]

This model of employers' recruitment behaviour will be formulated by means of separate equations for the choice of the *first* recruitment channel and the corresponding recruitment duration.

As regards the choice of the *first* recruitment channel, our analysis proceeds as follows. Suppose the employer 'knows' the differences in benefits (based on the productivity distribution among potential applicants and the reservation productivity) and costs (formed by direct search costs, selection and screening costs, and costs of 'foregone' productivity) between the various channels. Consequently, the employer is able to evaluate the difference (U) between the expected benefits (EB) and expected costs (EC) associated with the use of a certain search channel c first as follows:

$$U_c = EB_c - EC_c, \quad \forall c \tag{1}$$

We assume that the employer chooses the first search channel with the highest positive value U from a set of M channels.[6] Furthermore, the reduced form of the 'utility-variable' U_c is simply written as

$$U_c = U_c(\mathbf{z}) + \varepsilon_c \tag{2}$$

with

$\mathbf{z}$ = vector of vacancy characteristics, and

ε_c = an error term with density function $p(\varepsilon_c)$.

Equation 2 will be estimated by means of a discrete choice model.[7]

The second part of our employer's search model consists of a search duration equation, which will be formulated within the framework of the so-called hazard function approach (see Kiefer, 1988). Let $S_a^c(t)$ be the arrival rate of applicants selected via channel c. Pr_s^c is defined as the probability that the applicant selected via channel c is acceptable, i.e., the expected productivity of the applicant selected via channel c is higher than the reservation productivity. Then, the probability that a vacant job is filled (via channel c) during an infinitesimal short period $(t, t + dt)$ – given that it has been open until t – is the product of the arrival rate of selected applicants and the probability that an applicant is acceptable:

$$\delta_c(t)\, dt = S_a^c(t) \cdot Pr_s^c(t)\, dt \tag{3}$$

[3] Note that Dutch employers are not forced to search for applicants in this non-sequential way institutionally, but deliberately choose to do so for efficiency reasons.

[4] Employers may decide to screen a reduced number of applicants if the number in the pool is very large. On the other hand, applicants may also be considered on a case-by-case basis at the moment of arrival (i.e., the size of the pool is equal to one in a sequence).

[5] The full recruitment process corresponds to a non-trivial search model with a complicated timing for optimal decisions (such as the sequence of search channels to activate, the sizes of corresponding pools of applicants and the optimal dates of transition from one channel to another). This dynamic programming problem is, however, beyond the scope of this paper.

[6] This model of employers' search can be generalized by allowing the employer to choose more than one recruitment channel at the beginning of the recruitment process. It is also noteworthy that if we make the additional assumption that different search channels (or search channel mix) reach different non-overlapping segments of the population, then we have a case similar to the Pandora's box in Weitzman (1979).

[7] If the cumulative distribution of ε_c is the type I extreme value (normal), we arrive at the multinominal logit (probit) model with M states for the probability of choosing a certain search channel (see, for example, Maddala, 1983).

where $\delta_c(t)$ is the intensity at which vacancies are filled via channel c (i.e., the hazard rate). Now, it is assumed that

$$S_a^c(t) = S_a^c(t, z)$$
$$Pr_s^c(t) = Pr_s^c[P \geqslant R_t)] \tag{4}$$

Using Equations 3 and 4, we get

$$\delta_c(t)\,dt = S_a^c(t, z) \cdot Pr_s^c[P \geqslant R_t]dt \tag{5}$$

In our empirical application (see Section V), it appears to be impossible to identify the different components of the probability that vacancies are filled, because our data do not contain information on the arrival, screening and selection process. We can only estimate the 'reduced form' of (5) :

$$\delta_c(t) = \delta_c(t, z) \tag{6}$$

Although this unrestricted reduced form model makes no distinction between different stages in the recruitment process, the underlying structure may be helpful for the interpretation of the estimated effects. In particular, the effect of duration dependence may originate from a time-varying reservation productivity or changes over time in the arrival rate of selected applicants per unit of time.

In sum, we arrive at the following recursive model of employers' search:[8]

$$c = c[z] \tag{7}$$
$$\delta_c(t) = \delta_c(t, z) \tag{8}$$

where c is the recruitment channel with the highest value U_c (see also Equation 2).

To estimate this model, we have to specify the hazard function δ_c and the 'value variable' U_c. According to the proportional hazard model (introduced by Cox, 1972) δ_c is specified as:

$$\delta_c(t|z) = \exp(z'\beta_c) \cdot \tau_c(t) \tag{9}$$

with $\tau_c(t)$ = a function of elapsed duration t, and β_c = a vector of parameters.

For estimating this kind of model, we have to choose a functional form for the baseline hazard ($\tau_c(t)$).

Next, we specify U_c as

$$U_c(z) = z'a_c + \varepsilon_c \tag{10}$$

and if the cumulative distribution of ε_c is the type I extreme value we have

$$Pr(c|z) = \frac{\exp(U_c)}{1 + \sum_{c=1}^{M} \exp(U_c)} \tag{11}$$

IV. THE DATA AND EXPLANATORY VARIABLES

The model developed in Section III will be applied to data on job vacancies in the Netherlands. Micro data on vacancies, providing information on search methods and required skills of the applicant, are scarce in the Netherlands. We shall use in our analysis data from a survey of employers' recruitment behaviour ('How do Firms Recruit?') conducted in April/May 1986. This dataset consists of a sample of 723 filled vacancies.[9] In the sample, employers were questioned about the last vacancy filled in the past six months. In particular, questions were asked about the characteristics of the vacant job and the firm (including the requirements set for the applicant), their recruitment methods, and the time between the announcement of a vacant job and the acceptance of an applicant for that job (note that this is not necessarily equal to the total duration of the vacancy: recruitment may start before the job is actually vacant, and it may take time before an applicant who has been accepted actually starts working). The time period between announcement and acceptance (T) will be used as a proxy to measure vacancy duration in our model.

As regards the choice of recruitment channels, the dataset provides information on which channels have been used during the recruitment process. The following search categories may in principle be distinguished. First, employers may search for suitable applicants by using formal channels (advertising and labour exchange office). Second, informal channels may be used to fill a vacancy (recruitment within the firm and the use of informal contacts via friends and relatives outside the firm) and third, other channels (for example, consulting private employment offices) may be used. In addition, we know the *sequencing* of search channels (but not – in all cases – the exact moment of opening) and also the channel via which the vacancy has been filled (from now on referred to as the hiring channel). In our model, the choice of the first channel (c) will be used as a dependent variable. In addition, we shall examine the duration via the first chosen channel.

The exogenous variables (z) included in the data can be classified into two groups: variables related to the vacant job and variables related to the firm. The characteristics of the vacant job can be represented in terms of the applicant's required skills (educational level, specific educational skills, and work experience), the presence of age restrictions for the applicant, and the kind of contract offered to the applicant (permanent versus temporary, and full-time versus part-time). The characteristics of the firm are related to the sector

[8] A problem that may occur in this model is that the choice of recruitment channel is also determined by variables not included in the reduced form model (for example, the unknown wage level). This unknown variable (or error term) may also affect observed recruitment duration. In this case, we would end up with a simultaneous equation model in which the error term plays a role in both equations. However, when this error term is not significantly present in the duration equation, we may estimate the recursive model as specified in Equations 7 and 8.

[9] In Appendix A, the data source is discussed in more detail.

at hand (construction, industrial, services and quaternary sector, respectively) and the size of the firm (small, medium and large, respectively). Furthermore, the presence of a personnel department is taken into consideration. Appendix A contains a summary of the data.

V. EMPIRICAL RESULTS

In this section, we present the maximum likelihood estimates of the recursive model of the choice of first recruitment channel and the corresponding recruitment duration (as presented in Section III). Consequently, we consider in our duration model the speed (i.e., time to fill a job) of the first chosen search channel only.[10]

As mentioned in the previous section, we use a sample of filled vacancies to estimate the model. We assume here that the labour market is in a steady state during these six months, and hence the stock of vacancies is assumed to be constant in this period (November 1985–April 1986).[11] In a steady state, the observed sample of the most recently filled vacancies is a random sample of all vacancies which were filled during the past six-month period.[12] Since in a steady state inflow and outflow are assumed to be equal (both in size and composition), one may also consider the observed sample of filled vacancies as a random sample of jobs flowing into the vacant stock.

Our model of employers' search involves different hazard functions for each choice of first search channel. Now, let the length of a vacancy duration spell in our sample be denoted by T. Then, we have a completed spell of length T for the hazard model related to channel c, if the first search channel remains the only channel opened during the recruitment process (and – of course – becomes the hiring channel). Alternatively, we observe a right-censored (or incompleted) spell of length T_{rc} when the employer activates a second channel after a period of length T_{rc}.[13] In this case, the contribution of the duration part (related to channel c) to the likelihood function becomes equal to $S(T_{rc}) = 1 - F(T_{rc})$. However, for some cases in our data the moment at which the additional channel is activated (T_{rc}) is unknown; we do not observe the exact T_{rc} when the first channel activated becomes the hiring channel. So, we only know that this moment should be at some point in time between 0 and T. The contribution to the likelihood function of these cases then becomes the following:

$$L_i = \int_0^T S_i(t)\, dt \tag{12}$$

Finally, we take a piece-wise constant representation for the baseline hazard $\tau_c(t)$, so that

$$\tau_c(t) = \tau_c^j, \quad t_{j-1} < t \leqslant t_j \quad j = 1, \ldots, n \tag{13}$$

and assume a type I extreme value distribution for the error term (ε_c) in the choice model.

First, we discuss the outcomes of the multinominal logit model for the 'choice of first channel'. The main findings of this model are summarized in Table 2 (in Appendix B we show the multinominal logit estimates relative to the category 'others'; from these coefficients one can also obtain the results for choosing between other pairs of search channels presented in Table 2; for example, the choice between advertisements and informal contacts).[14] We observe that employers prefer to start searching by placing an advertisement instead of using informal contacts if (i) specific work experience is required;[15] (ii) the applicant should belong to a certain age group; (iii) an administrative job has to be filled; (iv) it concerns a permanent or full-time job; and (v) the firm is of medium size. Using advertisements is expected to be more costly than informal methods due to higher direct recruitment costs of placing an advertisement in a newspaper, higher costs of 'foregone' productivity (because it probably takes more time to fill a vacancy) and higher screening costs (because the firm has less reliable information about the applicants). Despite these costs, employers decide to use advertisements in the case of (permanent, full-time) jobs requiring specific work experience and a specific age, since they expect that the 'best' candidate – selected via a pool of applicants – will have such a level of productivity that this more than offsets the expected costs of recruitment. The same argument may apply to administrative jobs and vacancies originating in firms of medium size.

[10] The determinants of the timing of opening an additional channel are investigated in Gorter and van Ommeren (1996) by using multivariate duration techniques.

[11] Annual vacancy surveys among employers carried out by the Dutch Central Statistical Office show a constant level of the stock of vacancies in the relevant year 1986 (see also Fig. 1). Moreover, the decomposition of the stock into vacancy inflow and duration appears to be almost equal at the beginning and the end of the relevant period (see Van Ours and Ridder, 1991). This information supports the steady state assumption.

[12] This is an exogenously stratified random sample with strata being identical to firms: at most one vacancy per firm is sampled. Furthermore, we note that – given the assumption of a steady state – there is no length bias present in the data: long spells and short spells are equally likely in the sample.

[13] The approach of right-censoring at the moment of activation of a second channel has been adopted since the nature of the recruitment process itself may change; it becomes a competing risk model and the interaction between competing channels must be taken into account.

[14] The complete list of estimated parameters (and corresponding standard errors) is available from the authors on request.

[15] Specific experience appears to be significant at the 6% level when choosing between advertisements and informal contacts.

Table 2. *Overview of significant effects (at 5%) on the choice of first recruitment channel*

Choice of recruitment channel	Significant determinants
Advertisements versus informal contacts	* Administrative job relative to 'others' * Medium sized firm relative to small firm * No personnel department * Age requirements * Permanent job * Full-time job
Advertisements versus Labour exchange office	* Medium/large sized firm relative to small firm * Quaternary sector relative to industrial sector * Specific experience required relative to no experience required * Permanent job
Advertisements versus 'others'	* Administrative/sales job relative to others * Quaternary sector relative to industrial sector * No personnel department * Specific/non-specific experience required relative to no experience required * Age requirements
Informal contacts versus Labour exchange office	* Large sized firm relative to small firm * Service sector relative to industrial sector
Informal contacts versus 'others'	* Specific experience required relative to no experience required * Quaternary sector relative to industrial sector * Part-time job
Labour exchange office versus 'others'	* None

Advertisements are also preferred by employers to 'others' in the case of administrative/sales jobs, vacancies in the quaternary sector and requirements associated with age and work experience.

Another finding is that the labour exchange office is chosen instead of advertisements when (i) no experience is required; (ii) the position is temporary; and (iii) the vacant job occurs in a small firm or the industrial sector. In the latter case, employers also prefer the labour exchange office to the use of informal contacts. Hence, it seems that the labour exchange office is primarily activated as the first search channel when jobs in the 'secondary segment of the market' have to be filled.

The minimum level of education required appears to play no significant role in the decision to activate the first recruitment channel. A perhaps unexpected result is found for the presence of a personnel department. It is found that firms having a personnel department make significantly more use of informal search methods than advertisements. This effect might stem from a higher ability to recruit for applicants inside the firm.

Next, we turn to the estimation results of the hazard models for filling a vacancy via the first chosen search channel (see Table 3).[16] Clearly, the effects of the exogenous variables vary considerably over the recruitment channels. More specifically, we can draw the following conclusions. First of all, it takes significantly more time to fill jobs requiring high educational levels via advertisements than filling jobs requiring a low educational level. This implies that either there exists a shortage of workers with specific educational qualifications or relatively long selection and screening procedures are carried out when hiring a highly educated person. Requiring higher skill levels (namely, educational level and specific educational demands) leads to significantly longer durations when using informal contacts. This positive effect on the duration of filling a job suggests that it is more difficult to find a highly skilled employee, because – in the case of using informal contacts – screening procedures are expected to be relatively short. Large firms tend to use more time than small firms when a job is filled via an informal contact. Small firms probably have more flexible procedures than large firms during the hiring process. Moreover, vacant jobs classified into the 'medical, educational and social' occupational group are remarkably rapidly filled when using advertisements or informal contacts, while jobs in the quaternary sector are very difficult to

[16] Note that in Table 3 the effects of the variables on the hazard rate are presented; the effects on recruitment duration have the opposite sign.

Table 3. *Estimation results of hazard functions for filling a job vacancy via the first recruitment channel*

	Choice of first recruitment channel			
	Advertisements	Informal	Labour office	Others
Variables				
Required education				
low vocational	− 0.99 (0.48)*	− 0.43 (0.37)	0.14 (0.76)	0.17 (0.45)
secondary	− 1.17 (0.52)*	− 0.87 (0.46)*	0.46 (0.91)	0.30 (0.67)
extended vocational	− 1.91 (0.53)*	− 0.54 (0.46)	− 0.19 (1.29)	− 0.13 (0.75)
high	− 2.39 (0.54)*	− 1.10 (0.54)*	− 0.51 (1.28)	− 0.03 (1.11)
Occupational group				
administrative	0.56 (0.37)	0.54 (0.49)	− 1.28 (0.79)	− 0.76 (0.56)
sales	− 0.27 (0.40)	− 0.08 (0.51)	− 1.40 (1.28)	− 0.59 (0.63)
technical	0.14 (0.38)	0.42 (0.42)	− 0.67 (0.91)	− 0.72 (0.47)
medical/educ./soc.	0.92 (0.43)*	1.80 (0.71)*	1.00 (1.27)	0.30 (0.63)
production	0.46 (0.41)	0.35 (0.45)	− 1.11 (0.92)	0.49 (0.43)
Size of the firm				
medium	0.35 (0.21)	0.17 (0.27)	− 0.30 (0.47)	− 0.40 (0.35)
large	0.02 (0.24)	− 0.77 (0.34)*	− 0.89 (0.75)	− 0.52 (0.43)
Sector				
construction	0.03 (0.21)	0.45 (0.35)	− 0.25 (0.63)	0.01 (0.62)
services	0.18 (0.24)	0.19 (0.35)	0.11 (0.64)	− 0.09 (0.36)
quaternary	− 0.17 (0.28)	− 0.73 (0.45)	− 1.90 (0.88)*	− 0.24 (0.60)
Personnel department	− 0.23 (0.20)	− 0.06 (0.27)	− 0.66 (0.57)	0.24 (0.29)
Experience required				
non-specific	0.28 (0.32)	− 0.45 (0.39)	− 0.26 (0.62)	− 0.19 (0.34)
specific	− 0.09 (0.25)	− 0.29 (0.28)	− 0.19 (0.52)	− 0.43 (0.29)
Age requirements	0.19 (0.20)	− 0.34 (0.26)	− 0.07 (0.50)	− 0.44 (0.27)
Permanent job	− 0.39 (0.33)	− 0.45 (0.30)	− 1.33 (0.52)*	− 0.00 (0.44)
Full time job	− 0.27 (0.25)	0.19 (0.33)	− 0.63 (0.70)	0.11 (0.58)
Specific educ. req.	0.17 (0.20)	− 0.78 (0.31)*	− 0.61 (0.64)	0.60 (0.41)
New job created	0.24 (0.20)	0.07 (0.24)	0.31 (0.46)	0.21 (0.27)
Number of observations	237	238	92	156
Mean log-likelihood	− 1.61	− 0.92	− 0.68	− 1.21

Notes: Reference groups of the exogenous variables are given as follows: required education (primary), occupational group (others), size of the firm (small), sector of the firm (industrial), personnel department (no personnel department), required experience (no experience), age restrictions (no restrictions), permanent job (temporary), full time job (part time), new job created (replacement).
Standard errors in parentheses. * Significant at the 5% level.

fill via the labour exchange office. Finally, temporary jobs are more quickly filled than permanent jobs via the labour exchange office. Thus, apparently it is very difficult for the labour exchange office to match their registered (mainly unemployed) job seekers with permanent jobs. It is plausible that the permanent nature of the job is a signal of the importance of the job for the firm. Moreover, it is more difficult for firms to adjust possible mistakes made in actual recruitment for permanent jobs. In the light of these two observations, several explanations may be given for the difficulty in filling permanent jobs via the labour exchange office. For example, it takes the labour exchange office a great deal of time (e.g. due to pre-screening activities on motivation, ability, work-experience, etc.) to send applicants to the firm with a vacant permanent position. Another reason could be that employers apply lengthy screening procedures for applicants sent by the labour exchange office to fill a permanent position (probably due to the negative stigma attached to applicants showing up via the labour exchange office).

Now we present the patterns of the hazard rates over time (based on estimates of the piece-wise constant function τ with weekly steps for the first two months) for the recruitment channels advertisement and informal contacts (see Figs 2 and 3). As can be seen from the graphs, we find remarkably different patterns for the hazard rate over time.

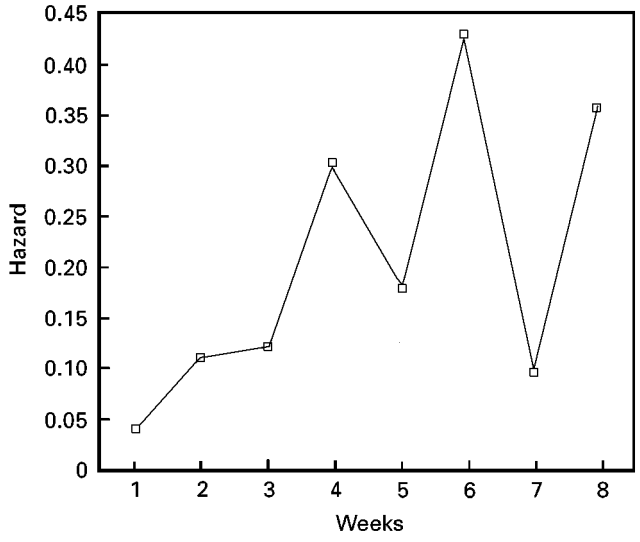

Fig. 2. *Hazard rate over time for using advertisements,* □ *Advertisements*

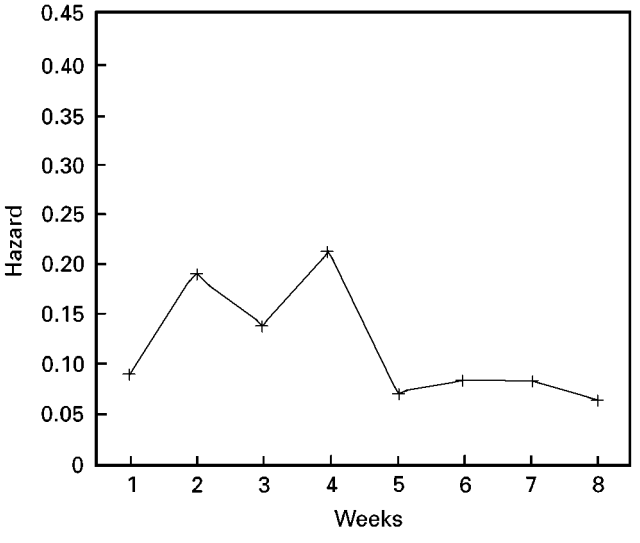

Fig. 3. *Hazard rate over time for using informal contacts* + *informal contacts*

If employers decide to use advertisements first, we see that the hazard rate is positive duration dependent with a peak of exit at six weeks.[17] This suggests that employers search non-sequentially, that is, they acquire a pool of applicants and select the next candidates from this pool after having screened the first to arrive. Hence, this result is a further confirmation of the conclusion drawn by van Ours and Ridder (1992) that when employers advertise they form a pool of applicants.

Our results, however, reveal also that if employers start searching by using informal contacts, the hazard rate appears to be negative duration dependent. This means that either the recruitment channel works quickly (as is shown by the relatively high level of the hazard rate during the first four weeks) or it does not work at all. In the latter case, employers decide to switch to other channels (for example, placing an advertisement) and hence, the vacancy will not be filled via the first chosen recruitment channel.

As regards the pattern for the labour exchange office and 'others', we find neither positive nor negative duration dependence of the hazard rate.

We conclude our analysis by testing whether there is unobserved heterogeneity present in the duration model for each recruitment channel c. For this purpose, the duration models are re-estimated with a two-points heterogeneity component $v = (v_1, v_2)$ included in the constant term of the hazard rate (while $Pr(v_1) = \alpha$ and hence, $Pr(v_2) = 1 - \alpha$). The parameters of the duration model $(\beta, \tau, \alpha, v_1, v_2)$ are estimated by maximum likelihood methods for each choice of the first search channel c. The results show that – for each submodel related to search channel c – the added heterogeneity components (v_1, v_2) converge to the same value, while the probability parameter a becomes 1/2. The parameters of the exogenous variables (z) and the time-varying dummies $(\tau_c(t))$ remained the same as before.[18] Apparently, the statistical variation of the hazard over time (as shown in Figs 2 and 3 for advertisements and informal contacts respectively) was already captured by the time-varying dummies. We conclude that neglected heterogeneity does not influence the outcomes of the reduced form duration models corresponding to each recruitment strategy and hence, it seems to be justified to estimate the duration and 'choice of first channel' models separately.

VI. CONCLUSIONS

In this paper, we used micro data on vacancy duration and search channels to analyse the recruitment strategy of employers. To this end, a model for the choice of recruitment strategy and the hazard of filling a vacancy via the chosen search strategy is developed. In the absence of unobserved heterogeneity in the 'reduced form' duration models for each search channel, this model can be estimated separately. The effects on the choice of the first recruitment channel are interpreted within the context of an employer's search model in which the employer chooses first the channel with the highest value for expected benefits minus expected costs. The underlying structure of the hazard rate of filling a vacancy via a specific recruitment channel is formulated in terms of the well known product of arrival rate (of selected applicants) and probability that an applicant is acceptable.

[17] After about two months (t greater or equal to eight weeks), we have taken the hazard rate to be constant over time.
[18] Detailed results are available from the authors on request.

The model is estimated for the Dutch labour market by taking the first chosen recruitment channel and corresponding recruitment duration as dependent variables. The results of the choice model show that advertisements are chosen as the first channel when work experience is required. It also appears that the labour exchange office is activated by employers as the first search channel in the case of vacancies originating in the 'secondary segment' of the labour market. Estimates for the hazard models suggest that if an advertisement is used, employers search in a non-sequential way. Moreover, advertising takes more time in the case of vacancies requiring high educational levels. This result is nicely in line with previous studies for the Dutch labour market (see van Ours and Ridder, 1992). A different picture emerges, however, when employers decide to start searching via informal contacts. The time-varying pattern of the hazard associated with this search method shows either rapid success (i.e., hiring an applicant via this channel) or hardly any success at all. Hence, screening and selection periods cannot take much time when informal contacts are first activated.

In summary, focusing on the choice of search methods and vacancy duration provided useful information about employers' recruitment procedures. Future structural analysis of the full recruitment strategy (sequencing and timing of search channels, length of screening and selection processes, direct recruitment costs of using a particular channel, and optimal size of the pool of applicants) may lead to an even more comprehensive analysis of the manner in which vacancies are filled.

ACKNOWLEDGEMENTS

The authors are indebted to Jos van Ommeren and Geert Ridder for their valuable comments on a previous version of this paper. The authors wish to thank also an anonymous referee for constructive and encouraging comments on the first draft of this paper.

REFERENCES

Aarts, L. J. M, Dercksen, W. J. and de Jong, P. R. (1993) Arbeidsongeschiktheid, een internationale vergelijking (Disability, an international comparison), *Sociaal Maandblad Arbeid*, **48**, 755–69.

Adnett, N. J. (1987) State employment agencies and labour market efficiency, *Cambridge Journal of Economics*, **11**, 183–96.

Barron, J. M. and Mellow, W. (1982) Labor contract formation, search requirements, and use of a public employment service, *Economic Inquiry*, **20**, 381–87.

Beaumont, P. B. (1978) The duration of registered vacancies: an exploratory exercise, *Scottish Journal of Political Economy*, **25**, 75–87.

Cox, D. R. (1972) Regression models and life tables, *Journal of the Royal Statistical Society B*, **34**, 187–220.

Gorter, C. (1991) The dynamics of unemployment and vacancies on regional labour markets, PhD thesis, Tinbergen Institute, Amsterdam.

Gorter, C., Nijkamp, P. and Rietveld, P. (1993) The impact of employers' recruitment behaviour on the allocation of vacant jobs to unemployed job seekers, *Empirical Economics*, **18**(2), 251–69.

Gorter, C. and van Ommeren, J. (1996) Sequencing, timing and filling rates of recruitment channels, Tinbergen Institute Discussion Paper, Ti 96–2813, Tinbergen Institute, Amsterdam.

Hamermesh, D.S. (1993) *Labor Demand*, Princeton University Press, Princeton, NJ.

Hassink, W. H. J. (1996) Worker flows and the employment adjustment of firms. An empirical investigation, Ph. D. thesis, Tinbergen Institute, Amsterdam.

Kiefer, N. M. (1988) Economic duration data and hazard functions, *Journal of Economic Literature*, June, 646–79.

Lancaster, T. (1979) Econometric methods for the duration of unemployment, *Econometrica*, **47**, 939–56.

Lindeboom, M., van Ours, J. C. and Renes, G. (1993) Matching employers and workers: an empirical analysis on the effectiveness of search, *Oxford Economic Papers*, **46**, 45–67.

Maddala, G. S. (1983) *Limited-dependent and Qualitative variables in Econometrics*, Cambridge University Press, Cambridge.

Mortensen, D. T. (1986) Job search and labor market analysis, in O. Ashenfelter and R. Layard, *Handbook of Labor Economics*, vol. II, Amsterdam, 849–919.

Nickell, S. (1979) Estimating the probability of leaving unemployment, *Econometrica*, **47**, 1249–64.

Osberg, L. (1993) Fishing in different pools, *Journal of Labor Economics*, **11**, 348–86.

Renes, G. (1989) Vacancy durations: shortages and surpluses in the labour market, paper presented at the European Meeting of the Econometric Society, Munich, West Germany.

Roper, S. (1988) Recruitment methods and vacancy duration, *Scottish Journal of Economics*, **35**, 51–64.

van Ours, J. C. (1989) Durations of Dutch job vacancies, *De Economist*, **137**, 309–27.

van Ours, J. C. (1990) An empirical analysis of employers' search, in *Panel Data and Labor Market Studies*, eds J. Hartog, G. Ridder and J. Theeuwes, North-Holland, Amsterdam.

van Ours, J. C. (1994) Matching unemployed and vacancies at the public employment office, *Empirical Economics*, **19**, 37–54.

van Ours, J. C. and Ridder, G. (1991) An empirical analysis of vacancy durations and vacancy flows: cyclical variation and job requirements, *European Economic Review*, **35**, 1143–55.

van Ours, J. C. and Ridder, G. (1992) Vacancy durations and the recruitment of new employees, *Journal of Labor Economics*, **10**, 138–55.

van Ours, J. C. and Ridder, G. (1993) Vacancy durations: search or selection?, *Oxford Bulletin of Economics and Statistics*, **55**, 187–98.

Weitzman, M. L. (1979) Optimal search for the best alternative, *Econometrica*, **47**, 641–54.

APPENDIX A

The data source

The data used in our analysis of vacancy duration stem from the survey 'How do Firms Recruit?'. This survey of employers' recruitment behaviour was undertaken for the first time in December 1984 and has been subsequently repeated

every year. In April/May 1986 a sample of 3198 firms was drawn. Non-response and other reasons (such as firm closures) reduced the sample to 2702 firms. The remaining sample was stratified according to (construction, industrial, service, and quaternary) sector and firm size (small, medium, large). From the sample in this survey, firms were selected on the basis of two criteria: first, that they should have had at least one vacancy which has been filled during the past six months; second, that the search for applicants used external channels only, or a combination of both internal and external channels. In this way a subsample of 723 firms – used in this paper – was selected.

Sample means of the variables

	Choice of first recruitment channel				
	Advertisements %	Informal %	Lab. office %	Others %	Entire sample %
Variables					
Required education					
primary	6	11	10	12	10
low vocational	19	32	41	40	30
secondary	22	18	23	19	20
extended vocational	32	23	15	20	24
high	21	16	11	9	16
Occupational group					
administrative	31	20	32	20	25
sales	15	11	7	9	11
technical	20	27	23	20	23
medical/educational/social	12	6	7	7	8
production	13	25	23	33	22
others	9	11	8	11	11
Size of the firm					
small	22	29	40	28	28
medium	47	32	39	39	39
large	31	39	21	33	33
Sector					
industrial	20	20	26	30	24
construction	14	26	28	23	21
services	27	29	23	31	28
quaternary	39	25	23	16	27
Personnel department	44	50	35	47	45
Experience required					
no work experience	18	16	38	42	28
non-specific	12	12	17	17	14
specific	70	62	45	41	58
Age requirements	55	45	54	49	50
Permanent job	90	80	79	85	84
Full time job	84	80	84	88	84
Specific educational requirements	56	42	34	40	45
New job created	30	35	35	37	34
Number of channels used					
one (first is hiring)	72	41	39	56	54
more than one (first is hiring)	20	15	24	25	20
additional is hiring	8	44	37	19	26
Mean vacancy duration (in weeks)	5.7	4.1	4.3	4.2	4.7
Number of observations	237	238	92	156	723

APPENDIX B

Multinominal logit estimates of 'choice of first recruitment channel' model; reference category is 'others'

	Choice of first recruitment channel, relative to 'others'		
	Advertisement	Informal	Labour office
Variables			
Constant	− 2.07 (0.75)*	0.43 (0.66)	− 0.02 (0.82)
Required education			
low vocational	− 0.60 (0.43)	− 0.33 (0.38)	0.08 (0.48)
secondary	− 0.14 (0.51)	− 0.13 (0.48)	− 0.24 (0.61)
extended vocational	0.25 (0.54)	0.36 (0.50)	− 0.05 (0.66)
high	0.60 (0.58)	0.77 (0.56)	0.36 (0.73)
Occupational group			
administrative	0.89 (0.46) *	− 0.13 (0.44)	0.94 (0.56)
sales	1.03 (0.51) *	0.48 (0.50)	− 0.08 (0.68)
technical	0.87 (0.47)	0.73 (0.44)	0.10 (0.58)
medical/educational/social	− 0.12 (0.58)	− 1.10 (0.60)	− 0.23 (0.76)
production	0.16 (0.48)	0.35 (0.43)	− 0.49 (0.56)
Size of the firm			
medium	0.49 (0.30)	− 0.32 (0.28)	− 0.31 (0.33)
large	0.24 (0.35)	0.14 (0.33)	− 0.73 (0.42)
Sector			
construction	− 0.38 (0.36)	0.26 (0.33)	0.10 (0.40)
services	− 0.05 (0.32)	0.26 (0.31)	− 0.55 (0.40)
quaternary	1.38 (0.41)*	0.88 (0.41)*	0.24 (0.49)
Personnel department	− 0.58 (0.27)*	− 0.03 (0.26)	− 0.38 (0.33)
Experience required			
non-specific	0.88 (0.36)*	0.29 (0.35)	0.20 (0.41)
specific	1.47 (0.27)*	0.99 (0.26)*	0.41 (0.32)
Age restrictions	0.74 (0.24)*	0.10 (0.23)	0.54 (0.29)
Permanent job	0.51 (0.35)	− 0.36 (0.30)	− 0.35 (0.36)
Full time job	0.04 (0.37)	− 0.74 (0.36)	− 0.05 (0.44)
Specific educational requirements	− 0.30 (0.30)	− 0.53 (0.30)	− 0.55 (0.37)
New job created	0.02 (0.25)	− 0.08 (0.24)	− 0.07 (0.30)
Number of observations		723	
− 2 log likelihood for full model		1722.6	
− 2 log likelihood for restricted model		1915.4	
% correctly predicted		46.1	
Maddala's pseudo R^2		0.23	

Notes: Reference groups of the exogenous variables are given in brackets: required education (primary), occupational group (others), size of the firm (small), sector of the firm (industrial), personnel department (no personnel department), required experience (no experience), age restrictions (no restrictions), permanent job (temporary), full time job (part time), new job created (replacement).
Standard errors in parentheses. * Significant at 5%.